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Childhood Football Play and Practice in Relation to Self-Regulation and National Team Selection; A Study of Norwegian Elite Youth Players

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Abstract

Childhood sport participation is argued to be important to understand differences in self-regulation and performance level in adolescence. This study sought to investigate if football-specific activities in childhood (6-12 years of age) is related to self-regulatory skills and national under 14- and 15-team selection in Norwegian elite youth football. Data of practice histories and self-regulatory skills of 515 youth football players selected at Norwegian regional level were collected and further analysed using multilevel analyses. The results revealed that high self-regulated players were more likely to be selected for national initiatives, and increased their involvement in peer-led football practice and adult-led football practice during childhood, compared to players with lower levels of self-regulation. While national level players reported higher levels of peer-led football play in childhood, the interaction effect suggest that the regional level players increased their involvement in peer-led play during childhood compared to national level players. In conclusion, the findings indicate that childhood sport participation may contribute to later differences in self-regulation, and highlights the importance of childhood engagement in football-specific play and practice in the development of Norwegian youth football players.

Keywords: Talent development, selection, youth sport, training history, learning

Introduction

To develop expertise in sports in general, and football specifically, practice have been identified as the perhaps most influential factor (see Baker & Young, 2014; Haugaasen & Jordet, 2012). Hence, a large body of research have focused on the importance and roles of distinct types of play and practice activities conducted during childhood and adolescence to achieve prominent levels of performance (e.g., Haugaasen, Toering, & Jordet, 2014a; Helsen, Starkes, & Hodges, 1998; Hornig, Aust, & Gullich, 2016). In addition to the direct learning of sport skills, it is suggested that childhood participation in distinct sport activities, such as coach- or peer-led play or practice activities, may contribute to the development of factors underpinning the amount and quality of practice that a player later invest in the sport, such as motivation (Côte, Lidor, & Hackfort, 2009) and cognitive capabilities (e.g., self-regulation; Howard, Vella, & Cliff, 2018).

The learning environments that children engage in can be conceptualized and located on a matrix formed by two axes - one which represents the social structure of the activity (peer lead vs adult lead) and one which represents the values associated with the activity (intrinsic vs extrinsic values; Côté, Erickson, & Abernethy, 2013; Hakkarainen, 1999). Activities that are initiated by the children themselves, such as peer-led football play and practice, represents contexts in which children can be creative and try new skills that they might not have dared to try under adult-led practice (Sagar & Lavallee, 2010), and studies on team ball sport players have found a positive association between childhood participation in sport-specific play (e.g., peer-led street football) and creativity (Memmert, Baker, & Bertsch, 2010). Furthermore, high amounts of peer-led football play during childhood have been positively associated with technical skills (Huijgen, Elferink-Gemser, Post, &

Visscher, 2010), and the development of perceptual skills and decision-making (Roca, Williams, & Ford, 2012; Williams, Ward, Bell-Walker, & Ford, 2012). However, practice that are conducted for more extrinsic reasons may lead to more effective skill acquisition, for instance when aiming to overcome performance plateaus (Coughlan, Williams, McRobert, & Ford, 2014), and adult-led practice may provide opportunities for well-designed drills, feedback, and instruction (O'Connor, Larkin, & Williams, 2017).

In a broader perspective, research has identified at least three possible pathways in explaining how childhood sport participation may lead to elite performance; 1) the early specialization pathway, consisting of large amounts of highly structured quality training (i.e., deliberate practice) in the main sport, typically starting at young age (Baker, Cobley, & Fraser- Thomas, 2009; Ericsson, Krampe, & Tesch-Römer, 1993); 2) the early diversification pathway, characterized by large amounts of peer-led play-activities in various sports throughout childhood (Côté, Baker, & Abernethy, 2007), and 3) the early engagement pathway, consisting of relatively high number of hours in play and practice activities in the primary sport, and little involvement in other sports (Ford, Ward, Hodges, & Williams, 2009). In Norwegian elite youth football, players have been found to typically accumulate substantially amounts of football-specific play and practice activities throughout childhood (Haugaasen et al., 2014a), and report relatively little involvement in other sports (Haugaasen, Toering, & Jordet, 2014b). While it should be noted that football players not necessarily follow the strict definition one specific pathway (Ford & Williams, 2012), studies have found that all three abovementioned pathways can lead to elite performance in sports (Ford & Williams, 2012; Haugaasen et al., 2014a; Helsen et al., 1998).

Besides the implications childhood sport participation have on sport-specific skills (e.g., creativity; Memmert et al., 2010), childhood sport involvement can be important for understanding characteristics that may explain why some players manage to conduct the amount and quality of practice required to reach elite level of performance (Côté et al., 2007; Côte et al., 2009; Durand-Bush & Salmela, 2002). In relation to the purpose of the present study, sport participation has been highlighted as a beneficial setting for the development of self-regulation (Jonker, Elferink-Gemser, Tromp, Baker, & Visscher, 2015), which have been associated with success in the sport domain in general, and in football specifically (Cleary & Zimmerman, 2001; Jonker, Elferink-Gemser, & Visscher, 2010; Toering, Elferink-Gemser, Jordet, & Visscher, 2009). Notably, self-regulation refers to the processes where individuals are "meta-cognitively, motivationally, and behaviourally active participants in their own learning process" (Zimmerman, 1989, p. 329), and is argued to be fostered in environments that provides opportunities for complex tasks, autonomous regulation of involvement, cooperation, support, and evaluation, which often is found in sports (Jonker et al., 2015; Perry, 1998). While a recent study found a bi-directional relationship between children`s participation in individual sports and self-regulatory skills (Howard et al., 2018), less is known about how childhood participation in distinct sport activities may lead to differences in self-regulatory skills among youth football players.

To our best knowledge, the relationship between childhood sport participation and self-regulation have previously only been explored in younger cohorts and outside the football domain (Howard et al., 2018). Further, with some exceptions (Haugaasen et al., 2014a, 2014b), studies have identified group mean differences of accumulated (Forsman, Blomqvist, Davids, Konttinen, & Liukkonen, 2016) or yearly

95 (Ford et al., 2009) practice hours, and have consequently not accounted for
96 individual development over time. Thus, the aim of this study was to explore how
97 participation in football-specific activities in childhood (6-12 years of age) may be
98 associated with self-regulatory skills and national team selection among Norwegian
99 elite U-14 & U-15 (i.e., Under 14 and Under 15 years) football players.

Method

Participants

515 Norwegian U-14 (N = 285) and U-15 (N = 230) youth football players participated in the study. Prior to the data collection, all players had been selected to their regional team, and were thereby considered the most promising players in their age category. Players from 17 of 18 football regions of Norway participated in the study. Of the total 515 players in the present study, 105 players (20.2 %) were selected for national initiatives, representing 96.3 % of the players (N = 109) in the relevant age cohorts that were selected for national initiatives.

Measures

Practice histories

In the present study, the amounts of practice conducted at different age levels was collected through a Norwegian practice history questionnaire (Haugaasen et al., 2014a). Haugaasen and colleagues adapted the questionnaire from previous research (e.g., Ford & Williams, 2012), and translated it to Norwegian using a forward and back-translation. The questionnaire recorded weekly amount of coach-led football practice, peer-led football practice and peer-led football play conducted at different age categories from the age of six to 12 years and how many months per year the participation lasted. Players also reported how many weeks per year they were restrained from practice due to illness, injuries etc. Based on these data, a yearly sum of engagement in the diverse activities were accumulated. Haugaasen et al. (2014a) tested the reliability of the questionnaire, and identified an intraclass correlation coefficient (ICC) of .86 between test and re-test three months later. In accordance

with previous studies (e.g. Ford & Williams, 2012), the instrument was thereby considered reliable.

Self-regulation

A condensed version of The Football-Specific Self-Regulation Learning Questionnaire (Toering, Jordet, & Ripegutu, 2013) was used to assess players` self-regulatory skills (i.e.., reflection, evaluation, and planning). The original instrument contains 22 questions and aim to measure self-regulated learning in the football context. The present study used a condensed version assessing the eight items that had a factor loading of .70 or higher in the original study by Toering and colleagues. Items was rated on a 5-point likert-scale, ranging from 1 (*never*) to 5 (*always*). The original instrument is considered a reliable and valid measure of football players aged 13 to 16 years (Toering et al., 2013). Internal consistency for the scale was calculated using the Cronbach's alpha (α= .86), and was considered satisfactory (Cortina, 1993). A median split was used to categorize players as high (>4, N = 254) or low (≤4, N = 238) on self-regulation.

Procedures

All 18 regions of the Norwegian Football Association (NFF) were prior to the data collection contacted by email or telephone and invited to participate in the study with players selected for regional U-14 and U-15 male teams. For the 17 regions that agreed to participate, questionnaires, information letter and a test protocol were distributed to a contact person, and an information letter was distributed to the players and their parents. The questionnaires were filled out individually with paper and pencil in a classroom-setting prior to a football team practice, with a test leader

present. The players were informed in writing and verbally that the survey was anonymous and voluntary, and that all information would be treated confidentially. Completed questionnaires were collected, enveloped and sealed by the test leader, and further distributed to the first author by mail. Ethical approval was obtained from the Norwegian Social Science Data Services (NSD), and the procedures were in accordance with the ethical standards of the first authors university.

Statistical analysis

The statistical significance of apparent associations between self-regulation and national team selection was explored using chi-square test. As the players reported their involvement in the three types of practice and play activities between the age categories 6-12 years, the data were considered longitudinal. We fitted a random intercept regression mixed model, which account for practice conducted by an individual player at the different age categories, with repeated measures of practice (level 1) is nested within players (level 2). We modelled the residual correlations by partitioning the total residual for subject *i* at time point *j* into a constant subject-specific random intercept or permanent component (u_i), plus a residual (ϵ_{ij}) which varies randomly over time (see Diggle, 2002; Everitt & Rabe-Hesketh, 2006). The model can properly identify potential differences in football-specific play and practice activities during developmental years within individual time points and between the groups. The random intercept model can be represented as follow:

$$y_{ij} = \beta^T X_{ij} + u_i + \epsilon_{ij} \quad (1)$$

Where $y_{ij}\ is$ practice time for subject *i* at time point *j*, and X_{ij} is the covariate of self-regulation. The random intercept represents individual players differences in the

mean amount of practice after controlling for covariates, which is decomposed to a between-subject component (τ^2) and a within-subject component (σ^2). The residual correlations can be written as

$$\text{Cor}\left(u_i + \epsilon_{ij}, u_i + \epsilon_{ij'}\right) = \frac{\tau^2}{\tau^2 + \sigma^2}.$$

The above intraclass correlation is interpreted as the proportion of the total residual variance of practice histories that is due to residual variability between players (see Diggle, 2002; Everitt & Rabe-Hesketh, 2006).

In addition to the main effects of time and group, we included the interaction effect between time and group, as the potential differences between the groups may not be the same over time. We also added a quadratic term of time to investigate if player's involvement in distinct types of practice evolves linearly, or tend to level off or increase over time. This procedure was done for each types of practice as a dependent variable, and with self-regulation (high/low) and team level (regional/national) as independent variables in separate analyses. Three analyses were thereby conducted for each of the two groups. All the analyses were performed using Stata 14.1 software (StataCorp, 2015).

Results

In the bivariate analysis, the data revealed that players scoring high on self-regulation (N = 238) were significant more likely to be selected at the national level compared to less self-regulated players (N = 254), χ^2 (1, N = 492) = 5.63, $p < .05$), as 25.2 % of the higher self-regulated players were selected for national initiatives compared to 16.5 % of the less self-regulated players.

Mean accumulated hours of the three types of football-specific play and practice activities conducted at the different age categories for groups of players scoring high and low on self-regulation and groups at regional and national level players is presented in Figure 1 and Figure 2 respectively, and results from the random intercept mixed models are presented in Tables 2 and 3. Analyses revealed that players involvement in all three types of football-specific play and practice increased over the age categories ($p < .05$). Further, the quadratic term of time was significant for peer-led practice ($p < .001$) and coach-led practice ($p < .001$), but not for peer-led play (p = .88, p = .92), suggesting that players involvement in peer-led practice and coach-led practice exhibited a non-linear growth over the years, while their involvement in peer-led play evolved linearly.

Results of the random intercept model with self-regulation as an explanatory variable (see Table 1) revealed no statistical significant main effects for any types of football-specific play or practice. However, while the estimated main effect of 12.5 additional hours of peer led football practice in favour of the high self-regulated group was not statistically significant; a significant interaction effect was found ($p <$ .001). Specifically, the players scoring high on self-regulation increased their involvement in peer-led football practice with an estimated 6.7 hours per year compared to the less-self regulated group ($p < .001$). Similar, high self-regulated

players increased their involvement in coach-led football practice with 2.1 hours for each year compared to the lower self-regulated player ($p < .05$).

**********INSERT FIGURE 1 APPROXIMATELY HERE**********

**********INSERT TABLE 1 APPROXIMATELY HERE**********

As seen in Table 2, a statistical significant main effect was found between national and regional players for peer-led play ($p < .05$), but not for peer-led or coach-led practice. Specifically, national level players reported higher levels of peer-led football play compared to regional players ($p < .05$). However, the interaction effects suggested that the regional players over time decreased their involvement in football play activities compared to regional players ($p < .01$). Apart from this, no statistical differences (main- or interaction effects) was identified between regional and national players. From the ICC, it is estimated that the total residual variance of practice histories that is due to residual variability between players varied between 0.75 and 0.78 across the three types of football activities (see Table 1 and 2).

**********INSERT FIGURE 2 APPROXIMATELY HERE**********

**********INSERT TABLE 2 APPROXIMATELY HERE**********

Discussion

The aim of this study was to investigate how childhood participation in football-specific activities may be associated with self-regulatory skills and national team selection in the context of Norwegian elite youth football. First, results revealed that high self-regulated players were more likely to be selected for national initiatives ($p < .05$). While no main effect of the distinct types football-specific activities (i.e., peer-led football play, peer-led football practice and adult-led football practice) during childhood was identified between players scoring high and low on self-regulation, high self-regulated players increased their involvement in peer-led football practice ($p < .001$) and adult-led football practice ($p < .05$) during childhood compared to players with lower levels of self-regulation. A significant main effect of peer-led play in favour of the national level players was identified ($p < .05$), however, the regional level players increased their involvement in peer-led play during childhood compared to national level players ($p < .001$). Overall, the findings in the present study indicates that sport participation in childhood may contribute to differences in self-regulatory skills among elite youth football players, and further supports a large body of literature on the importance of both quantity (i.e., practice histories) and quality (i.e., self-regulation) of football-specific activities to achieve prominent levels of performance (see e.g., Ford et al., 2009; Toering et al., 2009).

Practice have been identified as the perhaps most influential factor in the attainment of expertise (Baker & Young, 2014). Analysis revealed that over 70% of variability of practice histories over the different age categories is due to between-players variability, indicating that the players that had high involvement in a football activity at one time-point typically had high involvement on the other time-points. While the players reported to have conducted lower amounts of football-specific

activities during childhood compared to the findings in Haugaasen et al. (2014a), other studies have consistently found that players complete lower amounts of football-specific activities (e.g., Ford & Williams, 2012; Helsen et al., 1998; Hornig et al., 2016; Koslowsky & Botelho, 2010) compared to findings in Haugaasen et al. (2014a).

Players scoring high on self-regulation were more likely to be selected for national initiatives than less self-regulated players, which is in line with previous studies (e.g. Toering, Elferink-Gemser, Jordet, Pepping, & Visscher, 2012; Toering et al., 2009). Observational studies have indicated that high-self regulated football players take more responsibility in their learning, for instance by approaching the coach and instruct teammates more frequently (Toering et al., 2011). High self-regulated players may thereby benefit more from practice than less self-regulated players (Toering et al., 2009) which may explain the over-representation of high self-regulated players at national level. Thus, the importance of high-quality practice to reach elite level have been underpinned by several studies, for instance in qualitative studies among Olympic-level (Durand-Bush & Salmela, 2002) and world-class (MacNamara, Button, & Collins, 2010) athletes.

The theoretical and empirical connections indicating that distinct types of sport activities may be well suited for the development of self-regulation (e.g., Perry, 1998; Howard et al., 2018) was somewhat supported in the present study, given the significant interaction effect with high self-regulated players increasing their involvement in peer-led practice with estimated 6.7 hour/year ($p < .001$), and adult-led practice with estimated 2.1 hour/year ($p < .05$) compared to less self-regulated players. By experiencing various and complex situations without involvement from adults, children may learn independently to be more aware of which specific areas

they must develop to become better players, which is an important part of self-regulation (Toering et al., 2009). Peer-led practice further represent a context where participants can independently plan and decide what to do, and monitor and evaluate their performance in relation to their planned goal, which are central elements of self-regulation (Zimmerman, 2008). While Howard and colleagues' study on Australian children indicated that individual sport participation predicted changes in self-regulation, they also found that team-sport involvement did not, somewhat contrasting the present findings (Howard et al., 2018). Indeed, adult-lead practice may represent a sport arena where it is possible to participate without being particularly proactive. Also, some coaches may fail to construct the complex environment that exist in the actual football game (Gorman, 2010; William & Hodges, 2005) and is highlighted as beneficial for the development of self-regulation (Perry, 1998). The potential benefits of participating in organized football may thereby depend on the quality and characteristics of the activity.

Overall, as expressed in Figure 2, the national and regional players` practice histories shared much similarities, in line with findings in previous studies (Haugaasen et al., 2014a; Hornig et al., 2016). We found a significant main effect of peer-led football play in favour of the national players, in line with findings in Ford et al. (2009). Football-specific play during childhood appear to play a vital role in the development of important football skills, such as technical (Huijgen et al., 2010), perceptual, and decision-making skills (Roca et al., 2012; Williams et al., 2012). However, the present study found that the regional players increased their involvement in peer-led play compared to national players during childhood ($p <$ .01). This may indicate that the importance of play activities may be more predominant in the earliest parts of childhood, and that the transition between

sampling years (6-12 years of age) and specializing years (13-15 years of age) perhaps is more fluid than previously indicated (Côté et al., 2007). Therefore, we argue that the findings to some extent support the importance of diversification in childhood to achieve prominent levels of performance in adolescence, thus highlighting the possibility of diversification to occur within the primary sport (Ford et al., 2009).

In the sport domain in general, extrinsic motivated practice (i.e., deliberate practice) have generally been associated with success (see Macnamara, Moreau, & Hambrick, 2016 for a meta-analysis). While Helsen et al. (1998) found that international level players had conducted more peer-led practice than national and provincial players during childhood, more recent studies tend to find small or no differences in deliberate forms of practice (i.e., peer-led and adult-led practice) among players at different skill levels (Ford et al., 2009; Haugaasen et al., 2014a; Hornig et al., 2016). However, the importance of childhood participation in extrinsic motivated football practice for skill acquisition should not be ruled out. As studies have highlighted the importance of practice activities that replicate game-related conditions (Cushion, Ford, & Williams, 2012; O'Connor et al., 2017), and coaches can have adaptive or less adaptive influence on their athletes (Côté & Gilbert, 2009), differences in extrinsic motivated practice during childhood between national and regional players may exist in the quality and characteristics within these activities rather than quantity.

Most studies that seeks to explore the importance of childhood sport participation among athletes at various levels have used retrospective approaches (e.g., Baker, Côté, & Abernethy, 2003; Haugaasen et al., 2014a; Williams et al., 2012). In addition to the limitations of self-reported data, a prominent issue in these

retrospective approaches is the accuracy of the recalls, as the players must think back several years. Recent reliability assessments of practice history recalls have demonstrated good test-retest reliability using suitable statistical approaches (i.e., ICC; Ford, Low, McRobert, & Williams, 2010; Haugaasen et al., 2014a). Although athlete training history recalls thereby can be considered quite reliable and valid, one should bear in mind the potential error related to remembering several years back, and that developmental histories cannot be recalled entirely consistently and accurately (Hopwood, 2015).

With some exceptions (e.g., Haugaasen et al., 2014), studies on athletes` training histories have typically analysed the data using approaches such as ANOVA or independent t-tests (e.g., Forsman et al., 2016; Hornig et al., 2016). The present study applied a random intercept mixed model, which allowed us to account for the longitudinal and hierarchical nature of the practice histories (practice histories are nested within players and between players) and quantified the correlations among observations in the same cluster on the different time points (see e.g., Diggle, 2002). Another advantage of multilevel models is the handling of missing data, as observations can be included in the analysis even with the presence of missing data (Diggle, 2002; Quene & van den Bergh, 2014). While the present study is, to our knowledge, the first to use random intercept mixed models to analyse athlete`s practice histories, this statistical approach has been applied in other areas of research with similar types of design (see Diggle, 2002; Everitt & Rabe-Hesketh, 2006). However, we pinpoint that we have identified differences in practice histories between players at distinct performance levels and levels of self-regulation, and not whether the conducted practice caused these differences.

Further, we note that the sample in the present study represents the current best players under 14 and 15 years of age in Norway, but that the future development of the players remain uncertain. Consequently, the present study provides little information about the practice characteristics that may lead to professional level in adulthood, but rather the practice histories that may lead to selection into national initiatives in youth. Athletes in the present study may also have participated in play and practice activities in other sports during childhood. While investigation of the potential role of such involvement was beyond the scope of this paper, play and practice in other sports may contribute to the development of self-regulation and performance-level in football. For instance, Baker et al. (2003) found that team ball sport players (field hockey, netball and basketball) that had participated in additional activities needed fewer hours of sport-specific practice to become expert decision-makers compared to those who had participated only in their main sport, suggesting that additional activities may have a functional role in the development of sport-specific skills.

In conclusion, the present study found indications that sport participation in childhood may contribute to differences in self-regulatory skills and performance level among elite youth football players, and hence highlight the importance of childhood engagement in football-specific play and practice in the development of youth sport athletes. Furthermore, we encourage future studies to include measures of the microstructures and quality of childhood sport participation in relation to self-regulation and skill level in adolescence and adulthood.

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Figure1

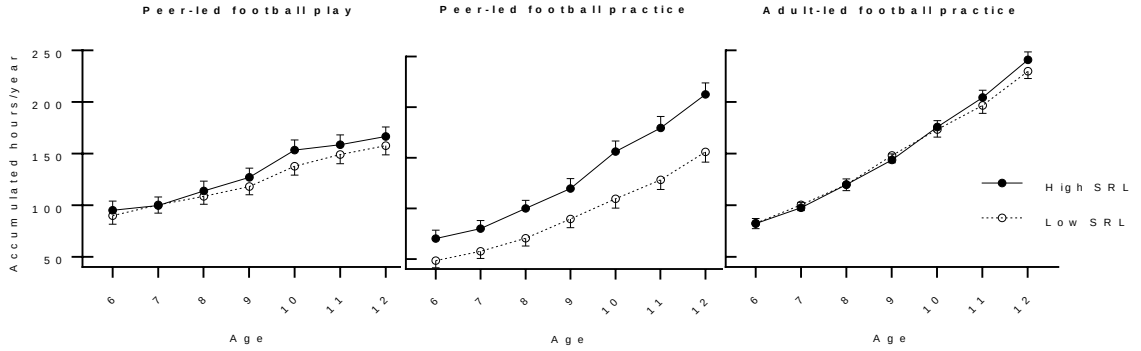

Figure 1: Mean accumulated hours of practice for different age categories by groups of players scoring high and low on self-regulation. Standard error is presented with upper bar for high SRL-group and with lower bar for low SRL-group.

Note: The visualization of the means over the different time points represent a simplification of the data

Figure 2: Mean accumulated hours of practice for different age categories by regional and national level players. Standard error is presented with upper bar for national level players, and with lower bar for regional level players.

Note: The visualization of the means over the different time points represent a simplification of the data compared to the more complex results presented in Table 2.

Table 1. Results of the random intercept model with fixed and random effects for model with groups of high or low levels of self-regulation

	Peer-led football play			**Peer-led football practice**			**Adult-led football practice**		
	Coef.	SE	95 % CI	Coef.	SE	95 % CI	Coef.	SE	95 % CI
Const.	71.0**	8.92	53.5, 88.4	38.1**	9.37	19.7-56.5	71.0**	6.76	57.8, 84.3
SRL	-.3	11.59	-23.1, 22.4	12.5	12.26	-11.5, 36.5	-7.0	2.14	-24.2, 10.1
Time	12.8**	2.82	7.3, 18.3	7.3*	2.89	1.63, 13.0	12.3**	.89	8.1, 16.5
Interact	1.7	1.17	-.6, 4.0	6.7**	1.20	4,2, 8.9	2.1*	.25	.4, 3.9
Time2	-.1	.33	-.7, .6	1.3**	.34	.7, 2.0	1.5**	6.75	1.0, 2.0
u_{0i}	101.4	3.78	94.3, 109.1	109.0	4.04	101.3, 117.2	77.0	2.89	71.5, 82.9
u_{1i}	56.7	.87	55.0, 58.4	58.7	.90	56.9, 60.5	44.2	.67	4.9, 45.5
Rho	0.76	.01	0.73, .79	0.78	0.01	.75, .80	.75	.02	.72, .78

Note: Fixed effects appear above dotted line, and random effects appear below dotted line. SE = Standard Error, Coef = Coefficient, Const. = constant, SRL = groups of high (=1) or low (=0) self-regulated players, Time = time effect, Interact = interaction between time and group, Time2 = Quadratic term of time, u_{0i} = residual intercept, u_{1i} = between-player intercept, Rho = Intraclass Correlation, * = $p < .05$, ** = $p < .01$.

Table 2. Results of the random intercept model with fixed and random effects for model with groups of national and regional players.

	Peer-led football play			**Peer-led football practice**			**Adult-led football practice**		
	Coef.	SE	95 % CI	Coef.	SE	95 % CI	Coef.	SE	95 % CI
Const.	64.6**	7.61	49.6, 79.5	45.6**	8.0	29.9, 61.4	63.6**	5.8	52.3, 74.9
Level	26.7*	13.5	.2, 53.1	-7.5	14.4	-35.8, 20.9	19.4	10.2	-.5, 39.3
TIME	14.2**	2.7	8.9, 19.6	9.8**	2.8	4.2, 15.3	13.2**	2.1	9.1, 17.3
Interact	-4,5**	1.3	-7.2, -1.9	1,2	1.4	-1.5, 4.0	-.9	1.0	-2.9, 1.1
Time2	<.1	.3	-.6, .7	1.4**	.3	.7, 2.0	1.5**	.2	1.1, 2.0
u_{0i}	101.5	3.7	94.5, 109.1	110.3	4.0	102.7, 118.5	77.0	2.8	71.7, 82.8
u_{1i}	56.4	.9	54.7, 58.1	58.7	.9	57.0. 60.4	44.1	.7	42.8, 45.4
Rho	.76	<.1	.73, .79	.78	<.1	.75, .81	.75	<.1	.72, .78

Note: Fixed effects appear above dotted line, and random effects appear below dotted line. SE = Standard Error, Coef = Coefficient Const. = constant, Level = groups of regional (= 0) or national (= 1) level players, TIME = time effect, Interact = interaction link between time and group, Time2= Quadratic term of time, u_{0i} = residual intercept, u_{1i} = between-player intercept, Rho = Intraclass Correlation, * = $p < .05$, ** = $p < .01$.

Childhood Football Play and Practice in Relation to Self-Regulation and National Team Selection; A Study of Norwegian Elite Youth Players

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Word count: 3993

Abstract

Childhood sport participation is argued to be important to understand differences in self-regulation and performance level in adolescence. This study sought to investigate if football-specific activities in childhood (6-12 years of age) is related to self-regulatory skills and national under 14- and 15-team selection in Norwegian elite youth football. Data of practice histories and self-regulatory skills of 515 youth football players selected at Norwegian regional level were collected and further analysed using multilevel analyses. The results revealed that high self-regulated players were more likely to be selected for national initiatives, and increased their involvement in peer-led football practice and adult-led football practice during childhood, compared to players with lower levels of self-regulation. While national level players reported higher levels of peer-led football play in childhood, the interaction effect suggest that the regional level players increased their involvement in peer-led play during childhood compared to national level players. In conclusion, the findings indicate that childhood sport participation may contribute to later differences in self-regulation, and highlights the importance of childhood engagement in football-specific play and practice in the development of Norwegian youth football players.

Keywords: Talent development, selection, youth sport, training history, learning

Introduction

To develop expertise in sports in general, and football specifically, practice have been identified as the perhaps most influential factor (see Baker & Young, 2014; Haugaasen & Jordet, 2012). Hence, a large body of research have focused on the importance and roles of distinct types of play and practice activities conducted during childhood and adolescence to achieve prominent levels of performance (e.g., Haugaasen, Toering, & Jordet, 2014a; Helsen, Starkes, & Hodges, 1998; Hornig, Aust, & Gullich, 2016). In addition to the direct learning of sport skills, it is suggested that childhood participation in distinct sport activities, such as coach- or peer-led play or practice activities, may contribute to the development of factors underpinning the amount and quality of practice that a player later invest in the sport, such as motivation (Côte, Lidor, & Hackfort, 2009) and cognitive capabilities (e.g., self-regulation; Howard, Vella, & Cliff, 2018).

The learning environments that children engage in can be conceptualized and located on a matrix formed by two axes - one which represents the social structure of the activity (peer lead vs adult lead) and one which represents the values associated with the activity (intrinsic vs extrinsic values; Côté, Erickson, & Abernethy, 2013; Hakkarainen, 1999). Activities that are initiated by the children themselves, such as peer-led football play and practice, represents contexts in which children can be creative and try new skills that they might not have dared to try under adult-led practice (Sagar & Lavallee, 2010), and studies on team ball sport players have found a positive association between childhood participation in sport-specific play (e.g., peer-led street football) and creativity (Memmert, Baker, & Bertsch, 2010). Furthermore, high amounts of peer-led football play during childhood have been positively associated with technical skills (Huijgen, Elferink-Gemser, Post, &

Visscher, 2010), and the development of perceptual skills and decision-making (Roca, Williams, & Ford, 2012; Williams, Ward, Bell-Walker, & Ford, 2012). However, practice that are conducted for more extrinsic reasons may lead to more effective skill acquisition, for instance when aiming to overcome performance plateaus (Coughlan, Williams, McRobert, & Ford, 2014), and adult-led practice may provide opportunities for well-designed drills, feedback, and instruction (O'Connor, Larkin, & Williams, 2017).

In a broader perspective, research has identified at least three possible pathways in explaining how childhood sport participation may lead to elite performance; 1) the early specialization pathway, consisting of large amounts of highly structured quality training (i.e., deliberate practice) in the main sport, typically starting at young age (Baker, Cobley, & Fraser- Thomas, 2009; Ericsson, Krampe, & Tesch-Römer, 1993); 2) the early diversification pathway, characterized by large amounts of peer-led play-activities in various sports throughout childhood (Côté, Baker, & Abernethy, 2007), and 3) the early engagement pathway, consisting of relatively high number of hours in play and practice activities in the primary sport, and little involvement in other sports (Ford, Ward, Hodges, & Williams, 2009). In Norwegian elite youth football, players have been found to typically accumulate substantially amounts of football-specific play and practice activities throughout childhood (Haugaasen et al., 2014a), and report relatively little involvement in other sports (Haugaasen, Toering, & Jordet, 2014b). While it should be noted that football players not necessarily follow the strict definition one specific pathway (Ford & Williams, 2012), studies have found that all three abovementioned pathways can lead to elite performance in sports (Ford & Williams, 2012; Haugaasen et al., 2014a; Helsen et al., 1998).

Besides the implications childhood sport participation have on sport-specific skills (e.g., creativity; Memmert et al., 2010), childhood sport involvement can be important for understanding characteristics that may explain why some players manage to conduct the amount and quality of practice required to reach elite level of performance (Côté et al., 2007; Côte et al., 2009; Durand-Bush & Salmela, 2002). In relation to the purpose of the present study, sport participation has been highlighted as a beneficial setting for the development of self-regulation (Jonker, Elferink-Gemser, Tromp, Baker, & Visscher, 2015), which have been associated with success in the sport domain in general, and in football specifically (Cleary & Zimmerman, 2001; Jonker, Elferink-Gemser, & Visscher, 2010; Toering, Elferink-Gemser, Jordet, & Visscher, 2009). Notably, self-regulation refers to the processes where individuals are "meta-cognitively, motivationally, and behaviourally active participants in their own learning process" (Zimmerman, 1989, p. 329), and is argued to be fostered in environments that provides opportunities for complex tasks, autonomous regulation of involvement, cooperation, support, and evaluation, which often is found in sports (Jonker et al., 2015; Perry, 1998). While a recent study found a bi-directional relationship between children`s participation in individual sports and self-regulatory skills (Howard et al., 2018), less is known about how childhood participation in distinct sport activities may lead to differences in self-regulatory skills among youth football players.

To our best knowledge, the relationship between childhood sport participation and self-regulation have previously only been explored in younger cohorts and outside the football domain (Howard et al., 2018). Further, with some exceptions (Haugaasen et al., 2014a, 2014b), studies have identified group mean differences of accumulated (Forsman, Blomqvist, Davids, Konttinen, & Liukkonen, 2016) or yearly

(Ford et al., 2009) practice hours, and have consequently not accounted for individual development over time. Thus, the aim of this study was to explore how participation in football-specific activities in childhood (6-12 years of age) may be associated with self-regulatory skills and national team selection among Norwegian elite U-14 & U-15 (i.e., Under 14 and Under 15 years) football players.

Method

Participants

515 Norwegian U-14 (N = 285) and U-15 (N = 230) youth football players participated in the study. Prior to the data collection, all players had been selected to their regional team, and were thereby considered the most promising players in their age category. Players from 17 of 18 football regions of Norway participated in the study. Of the total 515 players in the present study, 105 players (20.2 %) were selected for national initiatives, representing 96.3 % of the players (N = 109) in the relevant age cohorts that were selected for national initiatives.

Measures

Practice histories

In the present study, the amounts of practice conducted at different age levels was collected through a Norwegian practice history questionnaire (Haugaasen et al., 2014a). Haugaasen and colleagues adapted the questionnaire from previous research (e.g., Ford & Williams, 2012), and translated it to Norwegian using a forward and back-translation. The questionnaire recorded weekly amount of coach-led football practice, peer-led football practice and peer-led football play conducted at different age categories from the age of six to 12 years and how many months per year the participation lasted. Players also reported how many weeks per year they were restrained from practice due to illness, injuries etc. Based on these data, a yearly sum of engagement in the diverse activities were accumulated. Haugaasen et al. (2014a) tested the reliability of the questionnaire, and identified an intraclass correlation coefficient (ICC) of .86 between test and re-test three months later. In accordance

with previous studies (e.g. Ford & Williams, 2012), the instrument was thereby considered reliable.

Self-regulation

A condensed version of The Football-Specific Self-Regulation Learning Questionnaire (Toering, Jordet, & Ripegutu, 2013) was used to assess players` self-regulatory skills (i.e.., reflection, evaluation, and planning). The original instrument contains 22 questions and aim to measure self-regulated learning in the football context. The present study used a condensed version assessing the eight items that had a factor loading of .70 or higher in the original study by Toering and colleagues. Items was rated on a 5-point likert-scale, ranging from 1 (*never*) to 5 (*always*). The original instrument is considered a reliable and valid measure of football players aged 13 to 16 years (Toering et al., 2013). Internal consistency for the scale was calculated using the Cronbach's alpha (α= .86), and was considered satisfactory (Cortina, 1993). A median split was used to categorize players as high (>4, N = 254) or low (≤4, N = 238) on self-regulation.

Procedures

All 18 regions of the Norwegian Football Association (NFF) were prior to the data collection contacted by email or telephone and invited to participate in the study with players selected for regional U-14 and U-15 male teams. For the 17 regions that agreed to participate, questionnaires, information letter and a test protocol were distributed to a contact person, and an information letter was distributed to the players and their parents. The questionnaires were filled out individually with paper and pencil in a classroom-setting prior to a football team practice, with a test leader

present. The players were informed in writing and verbally that the survey was anonymous and voluntary, and that all information would be treated confidentially. Completed questionnaires were collected, enveloped and sealed by the test leader, and further distributed to the first author by mail. Ethical approval was obtained from the Norwegian Social Science Data Services (NSD), and the procedures were in accordance with the ethical standards of the first authors university.

Statistical analysis

The statistical significance of apparent associations between self-regulation and national team selection was explored using chi-square test. As the players reported their involvement in the three types of practice and play activities between the age categories 6-12 years, the data were considered longitudinal. We fitted a random intercept regression mixed model, which account for practice conducted by an individual player at the different age categories, with repeated measures of practice (level 1) is nested within players (level 2). We modelled the residual correlations by partitioning the total residual for subject *i* at time point *j* into a constant subject-specific random intercept or permanent component (u_i), plus a residual (ϵ_{ij}) which varies randomly over time (see Diggle, 2002; Everitt & Rabe-Hesketh, 2006). The model can properly identify potential differences in football-specific play and practice activities during developmental years within individual time points and between the groups. The random intercept model can be represented as follow:

$$y_{ij} = \beta^T X_{ij} + u_i + \epsilon_{ij} \quad (1)$$

Where y_{ij} is practice time for subject *i* at time point *j*, and X_{ij} is the covariate of self-regulation. The random intercept represents individual players differences in the

mean amount of practice after controlling for covariates, which is decomposed to a between-subject component (τ^2) and a within-subject component (σ^2). The residual correlations can be written as

$$\text{Cor}\left(u_i + \epsilon_{ij}, u_i + \epsilon_{ij'}\right) = \frac{\tau^2}{\tau^2 + \sigma^2}.$$

The above intraclass correlation is interpreted as the proportion of the total residual variance of practice histories that is due to residual variability between players (see Diggle, 2002; Everitt & Rabe-Hesketh, 2006).

In addition to the main effects of time and group, we included the interaction effect between time and group, as the potential differences between the groups may not be the same over time. We also added a quadratic term of time to investigate if player's involvement in distinct types of practice evolves linearly, or tend to level off or increase over time. This procedure was done for each types of practice as a dependent variable, and with self-regulation (high/low) and team level (regional/national) as independent variables in separate analyses. Three analyses were thereby conducted for each of the two groups. All the analyses were performed using Stata 14.1 software (StataCorp, 2015).

Results

In the bivariate analysis, the data revealed that players scoring high on self-regulation (N = 238) were significant more likely to be selected at the national level compared to less self-regulated players (N = 254), χ^2 (1, N = 492) = 5.63, $p < .05$), as 25.2 % of the higher self-regulated players were selected for national initiatives compared to 16.5 % of the less self-regulated players.

Mean accumulated hours of the three types of football-specific play and practice activities conducted at the different age categories for groups of players scoring high and low on self-regulation and groups at regional and national level players is presented in Figure 1 and Figure 2 respectively, and results from the random intercept mixed models are presented in Tables 2 and 3. Analyses revealed that players involvement in all three types of football-specific play and practice increased over the age categories ($p < .05$). Further, the quadratic term of time was significant for peer-led practice ($p < .001$) and coach-led practice ($p < .001$), but not for peer-led play ($p = .88$, $p = .92$), suggesting that players involvement in peer-led practice and coach-led practice exhibited a non-linear growth over the years, while their involvement in peer-led play evolved linearly.

Results of the random intercept model with self-regulation as an explanatory variable (see Table 1) revealed no statistical significant main effects for any types of football-specific play or practice. However, while the estimated main effect of 12.5 additional hours of peer led football practice in favour of the high self-regulated group was not statistically significant; a significant interaction effect was found ($p < .001$). Specifically, the players scoring high on self-regulation increased their involvement in peer-led football practice with an estimated 6.7 hours per year compared to the less-self regulated group ($p < .001$). Similar, high self-regulated

players increased their involvement in coach-led football practice with 2.1 hours for each year compared to the lower self-regulated player ($p < .05$).

**********INSERT FIGURE 1 APPROXIMATELY HERE**********

**********INSERT TABLE 1 APPROXIMATELY HERE**********

As seen in Table 2, a statistical significant main effect was found between national and regional players for peer-led play ($p < .05$), but not for peer-led or coach-led practice. Specifically, national level players reported higher levels of peer-led football play compared to regional players ($p < .05$). However, the interaction effects suggested that the regional players over time decreased their involvement in football play activities compared to regional players ($p < .01$). Apart from this, no statistical differences (main- or interaction effects) was identified between regional and national players. From the ICC, it is estimated that the total residual variance of practice histories that is due to residual variability between players varied between 0.75 and 0.78 across the three types of football activities (see Table 1 and 2).

**********INSERT FIGURE 2 APPROXIMATELY HERE**********

**********INSERT TABLE 2 APPROXIMATELY HERE**********

Discussion

The aim of this study was to investigate how childhood participation in football-specific activities may be associated with self-regulatory skills and national team selection in the context of Norwegian elite youth football. First, results revealed that high self-regulated players were more likely to be selected for national initiatives ($p < .05$). While no main effect of the distinct types football-specific activities (i.e., peer-led football play, peer-led football practice and adult-led football practice) during childhood was identified between players scoring high and low on self-regulation, high self-regulated players increased their involvement in peer-led football practice ($p < .001$) and adult-led football practice ($p < .05$) during childhood compared to players with lower levels of self-regulation. A significant main effect of peer-led play in favour of the national level players was identified ($p < .05$), however, the regional level players increased their involvement in peer-led play during childhood compared to national level players ($p < .001$). Overall, the findings in the present study indicates that sport participation in childhood may contribute to differences in self-regulatory skills among elite youth football players, and further supports a large body of literature on the importance of both quantity (i.e., practice histories) and quality (i.e., self-regulation) of football-specific activities to achieve prominent levels of performance (see e.g., Ford et al., 2009; Toering et al., 2009).

Practice have been identified as the perhaps most influential factor in the attainment of expertise (Baker & Young, 2014). Analysis revealed that over 70% of variability of practice histories over the different age categories is due to between-players variability, indicating that the players that had high involvement in a football activity at one time-point typically had high involvement on the other time-points. While the players reported to have conducted lower amounts of football-specific

activities during childhood compared to the findings in Haugaasen et al. (2014a), other studies have consistently found that players complete lower amounts of football-specific activities (e.g., Ford & Williams, 2012; Helsen et al., 1998; Hornig et al., 2016; Koslowsky & Botelho, 2010) compared to findings in Haugaasen et al. (2014a).

Players scoring high on self-regulation were more likely to be selected for national initiatives than less self-regulated players, which is in line with previous studies (e.g. Toering, Elferink-Gemser, Jordet, Pepping, & Visscher, 2012; Toering et al., 2009). Observational studies have indicated that high-self regulated football players take more responsibility in their learning, for instance by approaching the coach and instruct teammates more frequently (Toering et al., 2011). High self-regulated players may thereby benefit more from practice than less self-regulated players (Toering et al., 2009) which may explain the over-representation of high self-regulated players at national level. Thus, the importance of high-quality practice to reach elite level have been underpinned by several studies, for instance in qualitative studies among Olympic-level (Durand-Bush & Salmela, 2002) and world-class (MacNamara, Button, & Collins, 2010) athletes.

The theoretical and empirical connections indicating that distinct types of sport activities may be well suited for the development of self-regulation (e.g., Perry, 1998; Howard et al., 2018) was somewhat supported in the present study, given the significant interaction effect with high self-regulated players increasing their involvement in peer-led practice with estimated 6.7 hour/year ($p < .001$), and adult-led practice with estimated 2.1 hour/year ($p < .05$) compared to less self-regulated players. By experiencing various and complex situations without involvement from adults, children may learn independently to be more aware of which specific areas

they must develop to become better players, which is an important part of self-regulation (Toering et al., 2009). Peer-led practice further represent a context where participants can independently plan and decide what to do, and monitor and evaluate their performance in relation to their planned goal, which are central elements of self-regulation (Zimmerman, 2008). While Howard and colleagues' study on Australian children indicated that individual sport participation predicted changes in self-regulation, they also found that team-sport involvement did not, somewhat contrasting the present findings (Howard et al., 2018). Indeed, adult-lead practice may represent a sport arena where it is possible to participate without being particularly proactive. Also, some coaches may fail to construct the complex environment that exist in the actual football game (Gorman, 2010; William & Hodges, 2005) and is highlighted as beneficial for the development of self-regulation (Perry, 1998). The potential benefits of participating in organized football may thereby depend on the quality and characteristics of the activity.

Overall, as expressed in Figure 2, the national and regional players` practice histories shared much similarities, in line with findings in previous studies (Haugaasen et al., 2014a; Hornig et al., 2016). We found a significant main effect of peer-led football play in favour of the national players, in line with findings in Ford et al. (2009). Football-specific play during childhood appear to play a vital role in the development of important football skills, such as technical (Huijgen et al., 2010), perceptual, and decision-making skills (Roca et al., 2012; Williams et al., 2012). However, the present study found that the regional players increased their involvement in peer-led play compared to national players during childhood ($p <$ .01). This may indicate that the importance of play activities may be more predominant in the earliest parts of childhood, and that the transition between

sampling years (6-12 years of age) and specializing years (13-15 years of age) perhaps is more fluid than previously indicated (Côté et al., 2007). Therefore, we argue that the findings to some extent support the importance of diversification in childhood to achieve prominent levels of performance in adolescence, thus highlighting the possibility of diversification to occur within the primary sport (Ford et al., 2009).

In the sport domain in general, extrinsic motivated practice (i.e., deliberate practice) have generally been associated with success (see Macnamara, Moreau, & Hambrick, 2016 for a meta-analysis). While Helsen et al. (1998) found that international level players had conducted more peer-led practice than national and provincial players during childhood, more recent studies tend to find small or no differences in deliberate forms of practice (i.e., peer-led and adult-led practice) among players at different skill levels (Ford et al., 2009; Haugaasen et al., 2014a; Hornig et al., 2016). However, the importance of childhood participation in extrinsic motivated football practice for skill acquisition should not be ruled out. As studies have highlighted the importance of practice activities that replicate game-related conditions (Cushion, Ford, & Williams, 2012; O'Connor et al., 2017), and coaches can have adaptive or less adaptive influence on their athletes (Côté & Gilbert, 2009), differences in extrinsic motivated practice during childhood between national and regional players may exist in the quality and characteristics within these activities rather than quantity.

Most studies that seeks to explore the importance of childhood sport participation among athletes at various levels have used retrospective approaches (e.g., Baker, Côté, & Abernethy, 2003; Haugaasen et al., 2014a; Williams et al., 2012). In addition to the limitations of self-reported data, a prominent issue in these

retrospective approaches is the accuracy of the recalls, as the players must think back several years. Recent reliability assessments of practice history recalls have demonstrated good test-retest reliability using suitable statistical approaches (i.e., ICC; Ford, Low, McRobert, & Williams, 2010; Haugaasen et al., 2014a). Although athlete training history recalls thereby can be considered quite reliable and valid, one should bear in mind the potential error related to remembering several years back, and that developmental histories cannot be recalled entirely consistently and accurately (Hopwood, 2015).

With some exceptions (e.g., Haugaasen et al., 2014), studies on athletes` training histories have typically analysed the data using approaches such as ANOVA or independent t-tests (e.g., Forsman et al., 2016; Hornig et al., 2016). The present study applied a random intercept mixed model, which allowed us to account for the longitudinal and hierarchical nature of the practice histories (practice histories are nested within players and between players) and quantified the correlations among observations in the same cluster on the different time points (see e.g., Diggle, 2002). Another advantage of multilevel models is the handling of missing data, as observations can be included in the analysis even with the presence of missing data (Diggle, 2002; Quene & van den Bergh, 2014). While the present study is, to our knowledge, the first to use random intercept mixed models to analyse athlete`s practice histories, this statistical approach has been applied in other areas of research with similar types of design (see Diggle, 2002; Everitt & Rabe-Hesketh, 2006). However, we pinpoint that we have identified differences in practice histories between players at distinct performance levels and levels of self-regulation, and not whether the conducted practice caused these differences.

Further, we note that the sample in the present study represents the current best players under 14 and 15 years of age in Norway, but that the future development of the players remain uncertain. Consequently, the present study provides little information about the practice characteristics that may lead to professional level in adulthood, but rather the practice histories that may lead to selection into national initiatives in youth. Athletes in the present study may also have participated in play and practice activities in other sports during childhood. While investigation of the potential role of such involvement was beyond the scope of this paper, play and practice in other sports may contribute to the development of self-regulation and performance-level in football. For instance, Baker et al. (2003) found that team ball sport players (field hockey, netball and basketball) that had participated in additional activities needed fewer hours of sport-specific practice to become expert decision-makers compared to those who had participated only in their main sport, suggesting that additional activities may have a functional role in the development of sport-specific skills.

In conclusion, the present study found indications that sport participation in childhood may contribute to differences in self-regulatory skills and performance level among elite youth football players, and hence highlight the importance of childhood engagement in football-specific play and practice in the development of youth sport athletes. Furthermore, we encourage future studies to include measures of the microstructures and quality of childhood sport participation in relation to self-regulation and skill level in adolescence and adulthood.

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